Working towards a Meaningful Transition of Human Control over Automated Driving Systems

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Working Towards a Meaningful Transition of Human Control over Automated Driving Systems

MHC-ADS

The Questions

What do we know about human behaviour in automated driving?
What Human Factors play a role during automated driving?
What role do they play during a transition of control?
Which skills, rules, and knowledge are involved?
Can we go from a technical perspective to a human-oriented perspective?

The Aim

Develop a framework of human control over automated driving sytems.
Take a quantitative approach.
Use literature on skills, rules, and knowledge with automated driving.
Take a novice driver just granted their license as a baseline.
Maintain a EU-wide perspective.

The Process

Step 1: SAE Levels of Automation - the starting point.
- No Automation (level 0) to Full Automation (level 5).

Step 2: Classification of human behaviour (Rasmussen, 1983).
- Skill-, rule-, & knowledge-based behaviour.

Step 3: Human behaviour at level 0 - the baseline.
- Skills, rules & knowledge during manual driving set by EU.

Step 4: The Levels of Automation (level 1-3).
- Little literature; use of known ADAS & advanced training courses.

Step 5: The unknown - beyond human fall-back (level 4-5).
- Non-existant, open for debate and imagination.

The Results

Automation / Human	SAE 0 No Automation	SAE 1 Driver Assistance	SAE 2 Partial Automation	SAE 3 Conditional Automation	SAE 4 High Automation	SAE 5 Full Automation
Skill	128[1]	127 - 114	114	114 - 43	40 - 0?	39 - 0?
Rule	254[2]	255 - 250	250	250 - 69* - 66	51 - 29?	29 - 0?
Knowledge	65[3]	65 - 81	81	81 - 34?!	0 - ?!	0?

1 = Harmonisation of the Assessment of Driving Test Candidates (CIECA RSC working group, 2006)
2 = Convention on road traffic (United Nations, 1968; 2014)
3 = Various advanced driver training courses (a.o.)
* = In case of accident; i.e., when automation is not capable of avoiding an accident
? = Unknown situations at higher levels of automation
! = Driver skill-/rule-based behaviour may deteriorate to knowledge-based
| = Fall-back to human up to level 3 -> human needs at times adhere to level 0

The Implications

The decline in skill- and rule-based behaviour
The rise and fall of knowledge-based behaviour
The human driver as a fall-back mechanism
SAE level 4 and 5 automation: the path of the unknown

The "Now What?"

Mismatch between supply and demand!
Human-oriented taxonomy.
Empirical testing.
Qualitative approach?

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Meaningful Human Control over automated driving systems

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